"Western Treasure'— Deep, Wet Snow"

FEDERAL-STATE COOPERATIVE SNOW SURVEYS AND IRRIGATION WATER FORECASTS

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U. S. DEPARTMENT OF AGRICULTURE

for

MONTANA

MARCH 1, 1948

by

Montana Agricultural Experiment Station
and
Division of Irrigation, Soil Conservation Service
United States Department of Agriculture

in cooperation with

U. S. Forest Service
U. S. Geological Survey
U. S. National Park Service
State Engineer of Montana
U. S. Bureau of Reclamation

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FEDERAL-STATE COOPERATIVE
SNOW SURVEYS AND IRRIGATION WATER FORECASTS
FOR
MONTANA

Report Prepared

by

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Division of Irrigation
Soil Conservation Service
State Engineer of Montana
and
Montana State Agricultural Experiment Station
Bozeman, Montana

WATER SUPPLY OUTLOOK IN MONTANA, MARCH 1, 1948

The volume of water contained in the snow pack on the watersheds of Western Montana is above the average for the past 15 years, exceeding also conditions of a year ago in most cases. The Upper Missouri has the heaviest pack being 40% above the average, while the Yellowstone shows 36% above.

Reservoir storage and soil moisture conditions are also favorable.

Stream Flow - It is reported by the U. S. Geological Survey that the flow of the Yellowstone River at Corwin Springs is 20% above the median while the Judith Basin near Utica was reported to be 4% below the median flow.

High water was reported on the Clarks Fork of the Columbia due to rain and high temperatures.

Soil Moisture Conditions - At the Central Montana Branch Station soil moisture conditions are reported as favorable. By way of comparison the accumulated precipitation from September 1, 1947 to March 1, 1948 at Moccasin was 4.62 inches as compared to 8.05 inches for the corresponding period beginning September 1, 1946 and ending March 1, 1947.

At Huntley Field Station moisture penetration of 20 to 27 inches was reported in plots fallowed in 1947 whereas plots which had produced a crop of small grain or corn in 1947 were wet to a depth of only 6 to 8 inches. February was reported as the eighth consecutive month of below average precipitation.

Reservoir Storage - Reservoir storage in 17 reservoirs in the Missouri Basin having a combined useful capacity of 1,193,240 acre feet was reported by the U. S. Geological Survey as 67½% of capacity as compared to 65% a year ago.

In the Columbia Drainage of Western Montana 13 reservoirs with a total useful capacity of 1,988,445 acre feet were 39.3% full as compared to 43% full on a comparable date a year ago.

NARRATIVE FORECAST

Missouri Basin

Gallatin River - The average water content of the snow pack on the Gallatin River watershed ranges from a minimum of 18% below average at the 21 Mile snow course to a maximum of 97% above average at the Ross Peak course. If the present above normal precipitation on the watershed continues through the spring months, abnormally high water may be expected.

Madison River - The water content of the snow pack at four locations on the Madison watershed is slightly below the average for the past 15 year period of record. Present indications, therefore, are for a normal to slightly below normal runoff.

Jefferson River - The average water content at five snow courses ranges from a -8% at Miner Lake to a +42% at Pipestone Pass as compared with the average for the period of record on these five courses. The minus record was based upon only 4 years of data.

Main Stem Above Great Falls - At six locations on the watershed tributary to the Missouri above Great Falls the water content of the snow pack on March 1st ranges from +12% at Stemple Pass to +105% at Chesman above the average. This indicates a possibility of above average high water flow.

Sun River - The water content of the snow pack on Goat Mountain is 25% above the 16 year average for this location.

Marias River - The average water content at two locations on the Marias River watershed is about 15% above average for the period of record.

Musselshell - The average water content at five locations on the Musselshell watershed is from 24% at Kings Hill to 40% at Crystal Lake above the average over the period of record.

The prospects for a normal to above normal runoff on all tributaries to the Missouri River in Montana are very good according to snow measurements taken as of March 1st.

Yellowstone Basin

Yellowstone above Livingston - The water content of the snow cover on the Yellowstone watershed in Yellowstone Park is slightly above average. On one snow course, Lupine, near Mammoth, the water content was 11% below the 6 year average for this course. In contrast with this, the water content is 40% above average on Crevice Mountain. In general, indications are that a slightly above normal runoff may be expected on this part of the Yellowstone drainage.

Shields River - At the Porcupine Ranger Station near Wilsall the water content was found to be 37% above average at this location.

Boulder River - The snow survey taken on March 6th at Independence, near the head of the Boulder River, showed that the water content of the snow cover was 40% above the average at this location.

Clark's Fork River - Snow surveys were taken at two locations on the Clark's Fork watershed. At Camp Senia the water content was 94% above the 11 year average, while at Cooke City the water content was 32% above the 11 year average.

In general, the prospects are very good for the runoff to equal or exceed the normal for the Yellowstone Basin in Montana.

Columbia Basin

Clark's Fork - On the Clark's Fork of the Columbia River in Montana the snow pack is well above average. The water content readings as of March 1st range from 2% above average at Marias Pass on the Eastern boundary of the watershed to 57% above average at Nez Perce Pass on the Western divide of the Clark's Fork watershed.

Snow surveys taken at 11 different locations well distributed over the watershed indicate a heavy accumulation of moisture during the past winter months. Assuming that normal precipitation conditions will continue throughout the Spring months, an above average runoff may be expected from the Clark's Fork drainage.

PRELIMINARY FORECAST OF RUNOFF AT A NUMBER OF REPRESENTATIVE GAUGING STATIONS IN THE MISSOURI AND YELLOWSTONE BASINS

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Name of Stream	May - June	July-Aug.-Sept.
	Forecast (Sec. Ft. Days)	
Gallatin River at Gateway	92,000 ± 30%	31,000 ± 25%
Hyalite Creek	13,700 ± 15%	9,900 ± 15%
Madison River at West Yellowstone	31,000 ± 30%	30,000 ± 15%
North Fork of Musselshell River at Delpine	1,950 ± 20%	1,100 ± 15%
Yellowstone River at Corwin Springs	501,458 ± 15%	377,558 ± 30%
Shields River at Wilsall	17,000 ± 25%	3,600 ± 20%
Clark's Fork of Yellowstone at Chance	274,190 ± 20%	May-June-July
West Fork of Rock Creek Below Basin Creek	16,600 ± 30%	19,600 ± 25%
Red Lodge Creek Above Cooney Reservoir	10,669 ± 20%	Maximum Month

MONTANA SNOW SURVEYS MARCH 1, 1948

MISSOURI BASIN

WATERSHED and SNOW COURSE	LOCATION No. or State	Sec. --- Lat.	Twp. (or)	Range --- Long.	Elev.	Date of Survey	Snow Depth (inches) 1948	SNOW COVER MEASUREMENTS Water Content (inches) 1948	Same Approx. Date 1947	Same Approx. Date 1946	Past Record Years of Record (Incl. 1948)	Past Record Av. Water Content (inches)
Gallatin River												
Devil's Slide	Mont. 1	14	5S	6E	8100	3-3	71.4	23.2	16.0	18.7	14	14.9
Hood Meadow Ext.	" 2	22	4S	6E	6600	3-3	41.8	11.3	6.2	7.7	15	6.2
Mystic Lake	" 3	31	3S	7E	6600	3-1	40.9	11.8	7.7	8.1	13	6.3
New World	" 4	24	3S	6E	6600	3-2	48.8	14.7	10.7	10.8	7	8.8
Ross Peak	" 5	10	1N	6E	7000	3-1	48.3	14.0	5.4	8.1	10	7.1
21 Mile	" 6	1	11S	5E	7150	3-2	43.1	10.5	16.1	14.8	15	12.9
320 Ranch	"	12	9S	3E	6600	---	---	---	2.5	5.7	---	---
Madison River												
Hebgen Lake	" 7	22	11S	3E	6550	3-1	38.5	10.0	11.5	13.0	15	10.6
Norris Pasin	" 9		44.3N	110.7W	7500	---	---	---	8.9	7.8	---	---
21 Mile	" 6	1	11S	5E	7150	3-2	43.1	10.5	16.1	14.8	15	12.9
West Yellowstone	" 8	34	13S	5E	6700	3-2	32.2	7.0	10.3	10.6	15	9.5
Jefferson River												
Elkhorn	" 11	15	4S	12W	8450	3-2	35.2	8.4	11.0	8.9	15	7.1
Flashlight	" 10	22	8S	7W	6950	3-1	17.9	3.8	3.4	3.6	4	3.4
Gibbons Pass	" 13	4	2S	19W	7100	3-1	66.8	19.8	25.5	22.9	15	17.4
Miner Lake	" 12	10	6S	16W	6720	3-1	25.8	6.6	10.4	7.7	4	7.2
Pipestone	" 14	11	1N	7W	7200	2-27	27.0	5.7	5.7	3.9	11	4.0

MONTANA SNOW SURVEYS MARCH 1, 1948

MISSOURI BASIN

DRAINAGE BASIN and SNOW COURSE	LOCATION							SNOW COVER MEASUREMENTS					
								Snow Depth (in.)	Water Content (inches)				Past Record
	No. or State	Sec. --- Lat.	Twp. (or)	Range --- Long.	Elev.	Date of Survey		1948	1948	Same Approx. Date 1947	Same Approx. Date 1946	Years of Record (Incl.1948)	Av. Water Content (inches)
Main Stem Above Great Falls													
Chesman	Mont.	18	2	8W	6W	6200	3-3	28.6	8.4	6.0	3.0	13	3.9
Kings Hill	"	25	35	13N	7E	7950	3-1	47.3	12.0	13.5	15.8	14	9.7
Rimini Lower	"	15	13	8N	6W	6250	3-1	33.2	9.0	9.1	4.9	13	5.1
Rimini Middle	"	16	13	8N	6W	6800	3-1	45.3	12.4	13.0	7.7	14	7.5
Rimini Upper	"	17	19	8N	5W	8000	3-1	51.3	15.7	16.3	10.8	13	9.7
Stemple Pass	"	19	16	13N	7W	6900	3-2	35.2	8.5	12.0	8.2	14	7.6
Sun River													
Goat Mountain	"	20	47.5N		112.9W	7000	3-3	38.0	9.8	16.1	8.4	14	7.6
Marias River													
Marias Pass	"	21	48.3N		113.4W	5250	3-3	51.0	13.7	23.3	15.8	14	13.4
Rocky Boy	"	22	15	28N	16E	5200	3-1	22.1	6.5	4.7	5.5	7	5.1
Mussellshell River													
Crystal Lake	"	24	24	12N	17E	6100	3-1	48.7	14.4	9.7	11.5	8	10.3
Grasshopper	"	27	19	9N	8E	7000	2-24	24.5	5.1	5.2	3.6	11	3.9
Half Moon	"	23	22	12N	18E	6000	3-2	30.6	8.8	6.7	6.5	9	6.8
Kings Hill	"	25	35	13N	7E	7950	3-1	47.3	12.0	13.5	15.8	14	9.7
Orville Harris	"	26	31	10N	9E	6500	2-25	23.4	5.1	6.1	3.2	11	4.0

MONTANA SNOW SURVEYS MARCH 1, 1948

YELLOWSTONE

DRAINAGE BASIN and SNOW COURSE	LOCATION No. or State	Sec. — Lat.	Twp. (or)	Range — Long.	Elev.	Date of Survey	SNOW COVER MEASUREMENTS Snow Depth (in.) 1948	Water Content (inches) 1948	Same Approx. Date 1947	Same Approx. Date 1946	Years of Record (Incl.1948)	Past Record Av. Water Content (inches)
Yellowstone Park												
Canyon #1	Mont. 2	44.7N		110.5W	7750	3-2	40.6	9.5	11.3	10.3	12	9.0
Canyon #2	"	44.7N		110.5W	7750	3-2	45.1	10.6	14.4	12.6	3	---
Crevice Mt. #1	" 5	26	9S	9E	8400	2-23	46.4	11.2	8.8	7.7	10	7.9
Crevice Mt. #2	" 6	25	9S	9E	8150	2-23	47.3	11.8	9.5	8.5	9	8.5
Lake	" 1	44.6N		110.4W	7850	3-2	38.8	9.2	9.5	8.5	13	8.5
Lupine	" 3	44.9N		110.6W	7300	3-2	33.5	7.5	8.1	9.3	6	8.4
Shields River												
Porcupine	" 7	10	4N	10E	6500	3-1	19.5	5.2	4.1	4.8	11	3.8
Boulder River												
Hells Canyon	" 8	23	5S	12E	6000	---	---	---	4.1	3.3	---	---
Independence	" 9	22	7S	12E	8000	3-6	58.6	18.7	---	---	---	13.4
Clarks Fork												
Camp Senia	" 11	2	8S	18E	7890	2-26	38.0	9.3	6.2	4.7	11	4.8
Cooke City	" 10	25	9S	14E	7400	2-29	35.6	8.2	7.2	6.4	12	6.2

MONTANA SNOW SURVEYS MARCH 1, 1948

COLUMBIA BASIN

DRAINAGE BASIN and SNOW COURSE	LOCATION No. or State	Sec. — Lat.	Twp. (or)	Range — Long.	Elev.	Date of Survey	SNOW COVER MEASUREMENTS Snow Depth (in.) 1948	Water Content (inches) 1948	Same Approx. Date 1947	Same Approx. Date 1946	Past Record Years of Record (incl. 1943)	Past Record Av. Water Content (inches)
Bitterroot River												
Gibbons Pass	Mont. M13	4	2S	19W	7100	3-1	66.8	19.8	25.5	22.9	15	17.4
Nez Perce Camp	" 1	19	1S	23W	5580	3-1	46.0	12.0	15.8	13.8	12	10.1
Nez Perce Pass	Idaho	32	28N	16E	6575	3-1	64.0	20.9	21.3	17.5	10	13.3
Clark Fork												
Intergaard	Mont. 6	6	5N	13W	6450	3-1	—	8.3	6.6	5.9	10	5.5
Southern Cross	" 5	9	5N	13W	6500	3-1	—	5.7	3.8	4.8	10	4.1
Stemple	" M19	16	13N	7W	6900	3-2	35.2	8.5	12.0	8.2	15	7.7
Stuart Mill	" 4	19	5N	13W	6500	3-1	—	6.5	5.5	5.4	10	4.6
Picnic Ground	"	22	5N	6W	6300	3-1	—	5.3	---	---	---	---
Pipestone Pass	" 14	11	1N	7W	7200	2-27	27.0	5.7	5.7	3.9	11	4.0
Flathead River												
Marias Pass	" 21	48.19N		113°21'W	5250	3-3	51.0	13.7	23.3	15.8	14	13.4
No. Fork Jocko	" 13	3	17N	17W	6330	3-2	116.6	39.5	48.8	44.1	8	33.9
Big Creek	" 16	7	22N	18W	6750	2-27	108.9	36.0	49.0	44.0	8	32.2

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
STATE OF MONTANA, MONTHLY PRECIPITATION FOR
OCTOBER 1, 1947 - - MARCH 31, 1948

STATIONS	1947 OCTOBER		1947 NOVEMBER		1947 DECEMBER		1948 JANUARY		1948 FEBRUARY		1948 MARCH	
	Precip.	Dep.	Precip.	Dep.	Precip.	Dep.	Precip.	Dep.	Precip.	Dep.	Precip.	Dep.
WEST OF DIVIDE												
Butte	1.29	+0.50	1.50	+1.10	0.55	+0.11	0.68	+0.28	0.60	+0.16		
Deer Lodge	1.20	+0.52	1.27	+0.72	0.42	-0.09	0.27	-0.32	0.13	-0.30		
Hamilton	1.36	+0.45	1.10	+0.29	0.38	-0.33	1.90	+1.11	1.91	+1.16		
Missoula	1.09	+0.14	2.41	+1.51	0.78	-0.17	1.32	+0.47	0.97	+0.15		
CENTRAL DIVISION												
Babb	1.60	+0.42	0.82	-0.17	0.50	-0.44	0.71	-0.23	0.73	-0.09		
Dillon	0.33	---	0.44	---	0.35	---	0.28	-0.55	0.38	-0.34		
Fort Benton	0.38	-0.34	1.05	+0.46	0.56	+0.05	0.98	+0.32	0.56	+0.07		
Great Falls	0.54	-0.32	1.11	+0.43	0.44	-0.21	1.23	+0.62	0.36	-0.21		
Havre	0.48	-0.19	0.38	-0.23	0.27	-0.34	0.38	-0.35	0.47	-0.05		
Helena, WBO	0.55	-0.06	1.40	+0.95	0.27	-0.20	0.51	-0.05	0.22	-0.17		
Livingston	0.84	---	0.87	---	0.64	---	0.66	+0.12	0.55	+0.01		
Lewistown Arpt.	0.23	-0.13	0.88	+0.67	0.62	+0.42	1.03	+0.30	0.33	-0.44		
Mystic Lake	1.47	-0.37	1.90	+0.32	0.77	-0.27	3.53	+2.39	1.95	+0.87		
Bozeman	0.68	---	2.15	---	1.00	---	1.11	+0.24	0.65	-0.16		
EASTERN DIVISION												
Billings #2	0.52	---	0.63	---	0.91	+0.41	0.37	-0.26	0.23	0.19		
Circle	0.33	-0.52	0.23	-0.34	0.24	-0.51	0.14	-0.53	0.50	-0.11		
Frazer	0.43	-0.45	0.60	+0.07	0.46	+0.07	0.29	-0.12	0.75	+0.41		
Malta	0.66	-0.07	0.04	-0.37	0.38	-0.08	0.16	-0.31	0.62	+0.25		
Mildred	0.14	-0.59	0.38	+0.01	0.21	-0.11	0.53	+0.19	0.83	+0.57		
Medicine Lake	0.28	-0.47	0.94	+0.61	0.21	-0.07	0.51	+0.20	0.72	+0.40		
Miles City	0.39	-0.53	0.31	-0.26	0.28	-0.35	0.42	-0.24	---	---		
Fort Peck	0.33	-0.42	0.06	-0.41	0.29	+0.01	0.12	-0.26	---	---		

STORAGE IN RESERVOIRS OF MONTANA

MISSOURI RIVER BASIN — FEBRUARY 29, 1948

DATA FURNISHED BY OPERATING ORGANIZATIONS

COMPILED BY WATER RESOURCES BRANCH, U.S. GEOLOGICAL SURVEY, HELENA, MONT.

Reservoir	Located on or diverting from	Usable Capacity Acre-feet	Contents this month-end	Contents month ago	Contents year ago
a Lake Sewall	Missouri	37,800	+36,220	23,650	29,970
a Hauser Lake	Missouri	52,090	+45,730	47,180	49,050
a Holter Reservoir	Missouri	73,600	+42,250	69,170	56,490
b Fort Peck Reservoir	Missouri	19,000,000	13,200,000	13,130,000	13,850,000
c Ruby Reservoir	Ruby	38,850			+31,780
c Harrison Lake	Willow Creek	17,760			+ 9,800
a Hebgen Reservoir	Madison River	345,000	+283,700	291,500	267,600
a Madison Reservoir	Madison River	41,000	+37,140	33,460	34,320
c Smith River Res.	Smith River	10,700			
d Gibson Reservoir	N.Fk., & Sun R.	105,000	60,140	60,970	+58,150
d Willow Creek	N.Fk., Willow Cr.	32,300	16,700	16,410	+13,640
d Pishkun Reservoir	N.Fk., & Sun R.	32,000	20,840	20,840	+17,230
e Lower Two Medicine L.	Two Medicine R.	14,000			
e Four Horns Res.	Badger Cr.	20,000	+ 7,330	= 7,330	10,400
f Birch Creek Res.	Birch Creek	30,000	+19,030	16,780	28,290
f Lake Francis Res.	Birch, Dupuyer Cr.	112,000	+102,340	103,170	100,600
c Ackley Lake	Judith River	5,820		+ 4,700	+ 5,240
c Durand Reservoir	N.Fk.Musselshell	7,010			+ 6,610
c Deadman's Basin	Musselshell River	52,500			+47,000
c Martinsdale Res.	So.Fk.Musselshell	23,100			+ 8,690
d Fresno Reservoir	Milk River	127,200	71,800	74,090	55,240
d Nelson Reservoir	Milk River	66,800			27,440
a Mystic Lake	W.Rosebud Creek	20,800	+10,980	15,360	11,010

STORAGE IN RESERVOIRS OF MONTANA

MISSOURI RIVER BASIN (continued) FEBRUARY 29, 1948

Reservoir	Located on or diverting from	Usable Capacity Acre-feet	Contents this month-end	Contents month ago	Contents year ago
c Glacier Lake	Rock Creek	4,200			
c Cooney Reservoir	Red Lodge Creek	27,500		7,410	7,250
c Tongue River	Tongue River	73,900	9,580	8,740	7,550
d Sherburne Lake Res.*	Swiftcurrent Cr.	66,100	34,240	32,760	24,420
Lake Helena	Missouri River	10,450	7,200	7,900	8,830

Data furnished by:

a Montana Power Company
b U. S. Army Engineers
c Montana State Water Conservation Board
d Bureau of Reclamation
* Storage for Milk River Project
\+ First Day of Following Month
± Within Week of Month-End
e Office of Indian Affairs
f Valier Montana Land & Water Company
g Since Apr. 26, 1945, Lake Helena has been separated from Hauser Lake by control works permitting independent regulation.

STORAGE IN RESERVOIRS OF MONTANA

COLUMBIA RIVER BASIN — FEBRUARY 29, 1948

DATA FURNISHED BY OPERATING ORGANIZATIONS

COMPILED BY WATER RESOURCES BRANCH, U.S. GEOLOGICAL SURVEY, HELENA, MONT.

Reservoir	Located on or diverting from	Usable Capacity Acre-feet	Contents this date Acre-feet	Contents month ago	Contents year ago
a Georgetown Lake	Flint Creek	31,000	20,660	29,080	22,190
b E.Fk. Rock Cr. Res.	E.Fk. Rock Cr.	16,040			
b Nevada Creek Res.	Nevada Creek Res.	12,600			
b W.Fk.Bitterroot Res.	W.Fk.Bitterroot R.	31,700	10,000	10,000	10,000
c Como Lake	Rock Creek	34,800			
a Flathead Lake(Somers)	Flathead River	*1,791,000	681,300	971,300	782,600
d Little Bitterroot L.	Little Bitterroot R.	18,000	13,800	12,600	
d Hubbart Reservoir	Little Bitterroot R.	12,100	10,540	10,180	1,680
d Upper Dry Fork Res.	Dry Fork Creek	2,700	970	877	655
d Dry Fork Reservoir	Dry Fork Creek	4,000	2,240	1,860	1,500
d Twin Reservoir Canals	(Mission Valley)	600	170	150	214
d Pablo Res. Canals	(Mission Valley)	25,000	13,210	13,200	4,630
d Lower Crow Res. Crow Cr.	(Mission Valley)	10,350	8,140	4,660	8,060
d Kicking Horse Res. Canals	(Mission Valley)	8,350	6,240	6,120	5,810
d Ninepipe Res. Canals	(Mission Valley)	14,870	11,800	10,960	7,420
d McDonald Res.Post Cr.	(Mission Valley)	8,225	6,820	5,760	5,260
d Mission Res.Mission Cr.	(Mission Valley)	7,250	1,400	1,400	2,650
d Tabor Res. Dry Cr.	(Mission Valley)	23,300	1,940	1,850	3,690
d Lower Jocko L., Jocko R.	(Mission Valley)	7,600	Snowbound	Snowbound	0

Data furnished by:

a Montana Power Company
b Montana State Water Conservation Board
c Bitterroot River Irrigation District
d Office of Indian Affairs

* Contents at elev. 2893, considering 2878 as base. Contents at authorized min. elev. 2883, 572,300 acre-feet

First Day of Following Month
Within Week of Month-End